

1 We claim:

2 1. A capacitive vacuum measuring cell with a first housing body (1) made of  $Al_2O_3$  with a  
3 membrane (2) arranged at a small distance from said housing body with an edge seal in such a  
4 way that in between a reference vacuum chamber (25) is created where the surfaces of membrane  
5 (2) and the housing body (1) located at a small distance opposite each other are coated with an  
6 electrically conductive material (7) and constitute the measuring capacitance, and where a second  
7 housing body (4) made of  $Al_2O_3$  and featuring an edge seal is located opposite membrane (2)  
8 which together with said membrane forms a measurement vacuum chamber (26) in which ports  
9 (5) are provided for connecting the medium to be measured.

10 2. A measuring cell according to claim 1 where the electrodes (7) that enclose reference  
11 vacuum chamber (25) and which constitute the measurement capacitance are arranged at a  
12 distance of 2  $\mu m$  to 50  $\mu m$ , preferably 12 to 35  $\mu m$ .

13 3. A measuring cell according to claim 1 in which the first housing body (1) and the  
14 second housing body (4) with intermediate membrane (2) are symmetrically and tightly connected  
15 in the edge zone essentially without any stress.

16 4. A measuring cell according to claim 3 where the connection is implemented by fusion,  
17 by diffusion bonding or preferably by soldering and/or brazing, in particular with glass soldering  
18 and/or brazing material.

19 5. A measuring cell according to claim 1 where membrane (2) has a thickness in the range  
20 of 10  $\mu m$  to 250  $\mu m$ , preferably 10  $\mu m$  to 120  $\mu m$ .

21 6. A measuring cell according to claim 5 where the mean grain size of the membrane  
22 material is  $\leq 20 \mu m$ , preferably  $\leq 10 \mu m$ , in particular  $\leq 5 \mu m$ .

23 7. A measuring cell according to claim 5 where, in the cross-section of membrane (2), at  
24 least 2 grains, preferably at least 5 grains, exist across the thickness.

25 8. A measuring cell according to claim 1 wherein the unevenness of membrane (2) across  
26 its entire surface is not greater than 30% of the electrode spacing, preferably not greater than  
27 15%.

28 9. A measuring cell according to claim 1 wherein the unevenness of membrane (2) across

1 its entire surface is not greater than 10  $\mu\text{m}$ , preferably not greater than 5  $\mu\text{m}$ .

2 10. A measuring cell according to claim 1 wherein the purity of the  $\text{Al}_2\text{O}_3$  of membrane (2)  
3 is at least 94%, preferably at least 99%.

4 11. A measuring cell according to claim 1 where the contacts to the electrically conductive  
5 layers (7) are led out through sealed feedthroughs (6) on the first housing body (1).

6 12. A measuring cell according to claim 1 where on or in the first housing (1) a volume  
7 (13) for accommodating getter (10) is provided which features a connection (14) to the reference  
8 vacuum chamber (25) and where the volume (13) is sealingly tightly closed with a cover (8).

9 13. A measuring cell according to claim 12 where the getter is of the "non-evaporating"  
10 type.

11 14. A measuring cell according to claim 12 where getter (10) within volume (13) is  
12 pressed by means of spring (11) against cover (8).

13 15. A measuring cell according to claim 12 where a contacting material (12), preferably a  
14 soldering and/or brazing material, is provided between getter (13) and cover (8).

15 16. A measuring cell according to claim 1 where the pressure in the reference vacuum  
16 chamber (25) is lower than the lowest pressure to be measured, preferably lower by at least one  
17 decade.

18 17. A measuring cell according to claim 1 where the cell diameter is in the range of 5 to 80  
19 mm, preferably in the range of 5 to 40 mm.

20 18. A measuring cell according to claim 1 where at least one of the surfaces of housings  
21 (1, 4) is coated with an electrically conductive film for the purpose of shielding.

22 19. A process for manufacturing an  $\text{Al}_2\text{O}_3$  membrane for a measuring cell which comprises  
23 the following steps:

24 a. forming a membrane from an  $\text{Al}_2\text{O}_3$  slurry;

25 b. heating the membrane in a furnace a first time to sinter the membrane, with subsequent cool-  
26 down;

27 c. heating the membrane a second time for smoothing the membrane, with subsequent cool  
28 down.

1           20. The process according to claim 19 where a third heating step is performed for  
2 smoothing.

3           21. The process according to claim 20 where the sintering temperature of the first heating  
4 step is higher than the temperature of the subsequent smoothing step or steps, preferably by no  
5 more than 100°C.

6           22. The process according to claim 19 where, during the smoothing step or steps,  
7 membrane (2) is smoothed by pressing it between flat plates, particularly by loading the plates  
8 with weights.

9           23. The process according to claim 22 where membrane (2) is detached from the plates  
10 between smoothing steps and redeposited in offset position.

11           24. A process for manufacturing a measuring cell, comprising the following steps:

12           a. manufacturing a first  $\text{Al}_2\text{O}_3$  housing plate (1) with an electrically conductive surface (7), a  
13 connecting opening (14) that interconnects the surfaces of plate (1) and featuring two electrical,  
14 vacuum-tight feedthroughs (6) where one feedthrough (6) is electrically connected to the  
15 conductive surface (7);

16           b. manufacturing a second  $\text{Al}_2\text{O}_3$  housing plate (4) with a connecting opening that  
17 interconnects the surfaces of plate (4) where, on plate (4), a sealing connecting port (5) that  
18 communicates with the line is installed;

19           c. manufacturing of an  $\text{Al}_2\text{O}_3$  membrane (2) by a process according to claim 19 and subsequent  
20 coating of the one membrane surface with an electrically conductive film (7);

21           d. installation of the plates (1,4) in such a way that membrane (2) is positioned at a certain  
22 distance between the plates (1,4), and its peripheral edge zone is sealed vacuum tight with the  
23 plates (1,4), and that the electrically conductive layers (7) of the first plate (1) and the one of the  
24 membrane (2) are mutually opposite and constitute the measuring capacitance by defining a  
25 reference vacuum chamber (25), where layer (7) on membrane (2) is electrically conductive and  
26 connected to the other feedthrough (6) of the first plate (1), and the surface (7) which points  
27 away from connection port (5) of the second plate (4) together with membrane (2) defines a  
28 measurement vacuum chamber (26);

1 e. pumpdown of the reference vacuum chamber (25) by line (14) under activation of a getter  
2 (10) that is connected to line (14) where, after attainment of the desired vacuum, the line (14)  
3 with getter (10) is closed vacuum tight (8).

4 25. The process according to claim 19 where the membrane shape is cast or pressed from  
5 the  $\text{Al}_2\text{O}_3$  slurry, preferably from a ribbon-shaped  $\text{Al}_2\text{O}_3$  green body supported on a carrier foil,  
6 and which is subsequently pulled off the foil.

7 26. The process according to claim 24 where the membrane shape is cast or pressed from  
8 the  $\text{Al}_2\text{O}_3$  slurry, preferably from a ribbon-shaped  $\text{Al}_2\text{O}_3$  green body supported on a carrier foil,  
9 and which is subsequently pulled off the foil.

10 27. The measuring cell according to claim 1 wherein said measuring cell is capable of  
11 measuring pressures smaller than 1000 mbar with a resolution of better than 1%.

12 28. The measuring cell according to claim 27 wherein said measuring cell is capable of  
13 measuring pressures smaller than 1 mbar.

14 29. The measuring cell according to claim 28 wherein said measuring cell is capable of  
15 measuring such pressures with a resolution of better than .3%.

16 30. The measuring cell according to claim 27 wherein said measuring cell is capable of  
17 measuring such pressures with a resolution of better than .3%.